

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device comprising:

5 forming a semiconductor element in a semiconductor wafer;

forming a groove by performing half-cut dicing on the semiconductor wafer along a dicing line;

10 irradiating a dicing region of the semiconductor wafer with a laser beam to melt or vaporize a cutting streak formed by dicing;

adhering an adhesive tape to a semiconductor element formation surface of the semiconductor wafer; and

15 grinding a backside of the semiconductor element formation surface to at least a depth reaching the groove.

20 2. A method according to claim 1, further comprising planarizing a back surface of a semiconductor chip by at least one of wet etching, plasma etching, polishing, buffing, and CMP, after the grinding.

3. A method according to claim 1, wherein the irradiation with the laser beam is performed underwater.

25 4. A method according to claim 1, wherein the irradiation with the laser beam is performed in a vacuum.

5. A method according to claim 1, wherein a wavelength of the laser beam is 266 to 1,064 nm.

6. A method according to claim 1, wherein an output of the laser beam is 0.8 to 4.5 W.

5        7. A method according to claim 1, wherein a moving velocity of an irradiation position of the laser beam is 1 to 400 mm/sec.

8. A method according to claim 1, wherein the semiconductor element in the semiconductor wafer  
10 comprises a low-dielectric-constant film, and the irradiation with the laser beam comprises melting or changing properties of the low-dielectric-constant film exposed to the dicing region.

9. A method of manufacturing a semiconductor  
15 device comprising:

forming a semiconductor element in a semiconductor wafer;

forming a groove by performing half-cut dicing on the semiconductor wafer along a dicing line;

20        adhering an adhesive tape to a semiconductor element formation surface of the semiconductor wafer;

grinding a backside of the semiconductor element formation surface to at least a depth reaching the groove; and

25        irradiating a dicing region of a semiconductor chip, formed by dividing the semiconductor wafer in the grinding step, with a laser beam, thereby melting or

vaporizing a cutting streak formed by dicing.

10. A method according to claim 9, further comprising planarizing a back surface of the semiconductor chip by at least one of wet etching, plasma etching, polishing, buffing, and CMP, after the grinding.

11. A method according to claim 9, wherein the irradiation with the laser beam is performed underwater.

12. A method according to claim 9, wherein the irradiation with the laser beam is performed in a vacuum.

13. A method according to claim 9, wherein a wavelength of the laser beam is 266 to 1,064 nm.

14. A method according to claim 9, wherein an output of the laser beam is 0.8 to 4.5 W.

15. A method according to claim 9, wherein a moving velocity of an irradiation position of the laser beam is 1 to 400 mm/sec.

16. A method according to claim 9, wherein the semiconductor element in the semiconductor wafer comprises a low-dielectric-constant film, and the irradiation with the laser beam comprises melting or changing properties of the low-dielectric-constant film exposed to the dicing region.

17. An apparatus for manufacturing a semiconductor device comprising:

a dicer which forms a groove by performing half-cut dicing on a semiconductor wafer along a dicing line;

5 a tape adhering apparatus which adheres an adhesive tape to a semiconductor element formation surface of the semiconductor wafer;

10 a grinding apparatus which grinds a backside of the semiconductor element formation surface of the semiconductor wafer to at least a depth reaching the groove formed by the half-cut dicing; and

15 a laser emitting apparatus which moves an irradiation position of a laser beam in accordance with a dicing position of the dicer, and melts or vaporizes a cutting streak formed in a dicing region of the semiconductor wafer.

20 18. An apparatus according to claim 17, further comprising at least one of a wet etching apparatus or plasma etching apparatus which etches a ground surface of the semiconductor wafer, and a polishing apparatus, buffing apparatus, and CMP apparatus which polish the ground surface of the semiconductor wafer, after the back surface of the semiconductor wafer is ground by the grinding apparatus.

25 19. An apparatus according to claim 17, further comprising a processing bath which accommodates the semiconductor wafer in water.

20. An apparatus according to claim 17, further

comprising a vacuum chamber which accommodates the semiconductor wafer.